Amendments to the Drawings:

The first attached sheet of drawings includes changes to FIG. 4A. This sheet, which includes FIGS. 4A, 4B and 4C, replaces the original sheet. In FIG. 4A, reference numeral "406" has been corrected to "403" to designate a composite side, and reference numeral "406" has been added to designate the linear apex.

The second attached sheet of drawings includes changes to FIG. 4G. This sheet, which includes FIGS. 4D, 4E, 4F, 4G and 4H, replaces the original sheet. In FIG. 4G, the lead line for reference number 434 has been extended to contact linear apex 434.

The third attached sheet of drawings includes changes to FIG. 6A and to FIG. 6B. This sheet, which includes FIGS. 5, 6A and 6B, replaces the original sheet. In FIGS. 6A and 6B, "S" has been corrected to "Σ", the "4" above "S" has been deleted, and the "∧" above "y" has been deleted.

Attachment: Replacement Sheets
Annotated Sheets Showing Changes

REMARKS

Applicant has canceled claims 7, 15, 23, 31 and 39. Various paragraphs throughout the specification have been amended. Figures 4A, 4G, 6A and 6B have also been amended.

Claims 1-6, 8-14, 16-22, 24-30, 32-38 and 40 are pending. Reconsideration of this application, as amended, is requested.

Drawings

In Figure 4A, reference numeral "406" has been corrected to "403" to designate a composite side, and reference numeral "406" has been added to designate the linear apex.

In Figure 4G, the lead line for reference numeral 434 has been extended to the linear apex.

Figures 6A and 6B have been corrected to have "Σ" rather than "S". Additionally, the "4" above "S" has been deleted, and the "^" above "y" has been deleted.

112 Rejections

Claims 7, 15, 23, 31 and 39 were rejected under 35 U.S.C. 112, second paragraph. Claims 7, 15, 23, 31 and 39 have been canceled. Withdrawal of this rejection is requested.

The Claims, Generally

The presently claimed invention is directed to methods of making abrasive articles and use of abrasive articles. The abrasive articles include a plurality of protruding units, the units extending in at least two dimensions. Each protruding unit has a base defined by a periphery. Distal to the base, each unit has a distal region, which when projected on to a plane that is coplanar with its respective base, falls within the base periphery. Between this distal region and a center point of the base is an offset vector. The sum of the offset vectors for the plurality of protruding units does not approach zero.

Section 103 Rejections

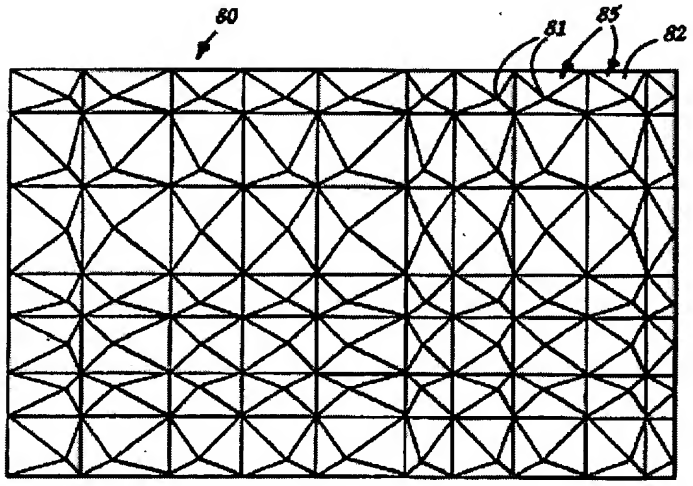
Claims 1-40 were rejected under 35 U.S.C. 103(a) as obvious over Hoopman (U.S. Patent No. 5,672,097). Applicant respectfully disagrees with this rejection.

Applicant agrees that Hoopman discloses abrasive articles and methods of making it, where in the method comprises elements of the claimed specific steps. The article of Hoopman includes protruding units (composites) that can be of various shapes, with the angle of intersection of adjacent arrays of composites being different. The bases of the composites may or may not abut one another.

Applicant also agrees that Hoopman discloses that the protruding units can be cubic, pyramidal, pyrismatic, conical, cylindrical, truncated pyramidal, truncated conical and the like. All of these shapes specifically recited are symmetrical around their periphery with a centrally positioned distal end. Hoopman does not discuss that the distal region of each of the protruding units can be offset, so that the sum of the vectors of the offset does not approach zero.

Reproduced below is FIG. 8 from Hoopman. FIG. 8 illustrates an abrasive article 85 with abrasive composites 80 having faces 82 and apex 81. Applicant agrees that some of the composites 80 have an apex 81 that is offset from the center of the composite base. However, as can be seen in FIG. 8, the offset of the distal regions is random, and the sum of the vectors of the offset does appear to approach zero.

FIG.8



The pending claimed invention differs from the teachings of Hoopman, including the illustration of FIG. 8, in that the pending claims recite that "the offset vectors for the plurality of protruding units do not exhibit a sum that approaches a limit of zero" (see claim 1, lines 10-11; claim 9, lines 10-11; claim 17, lines 12-13; claim 25, lines 10-11; claim 33, lines 10-11). There is no discussion in Hoopman of having the sum of the offset vectors not approach a limit of zero.

It would not have been obvious, from the disclosure of Hoopman, which has some offset point distal regions going various directions, to arrive at the abrasive protrusions or abrasive article made by the pending claims. Hoopman, although he suggests that any shape of composite may be used, does not direct one, or suggest to one, shapes with distal regions that are offset as required. Hoopman does not recognize the advantage of having the distal regions offset, as required by the pending claims.

Submitted herewith is a Declaration of Scott R. Culler, one of the named inventors on this application. As described by Mr. Culler, Example D1, the example having an offset peak topography, with the peak vectors not summed to zero, had better performance than the comparative example having an offset peak topography, but with the sum of the peak vectors approaching zero. The comparative example topography was that of Hoopman '097, except larger in size (i.e., 635 micrometers tall) than the example of Example 1 of Hoopman '097 (i.e., 355 micrometers tall).

As can be seen in the Declaration, although Example D1 performed 9% (only 0.9 grams) worse than Comparative Example D2 after one test cycle, after 5 test cycles, Example D1 performed 28% (24 grams) better than Comparative Example D1, and after 10 test cycles, Example D1 performed 41% (64.4 grams) better than Comparative Example D1. These results show that after the initial period where the peaks of the protrusions are dulled, the abrasive protrusions, made by the method of the pending claims, produce a better performance than those of Hoopman. Referring to the graph provided in the Declaration, it is seen that the difference in the performance between the example according to the invention and the comparative example increases over time of use. It would not have been obvious to one skilled in the art of structured abrasives, that having an offset peak, with the sum of offset vectors not approaching zero, would be improved over the offset peak structured abrasives of Hoopman.

Applicant contends that the claims, directed to methods of making abrasive articles having the offset vectors for the protruding units not exhibiting a sum that approaches a limit of zero, are patentable, and requests withdrawal of the rejections.

Summary

In view of the above amendments and remarks, Applicant respectfully requests a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone Applicant's attorney Rick L. Franzen, Reg. No. 51,702, at 651.736.6432.

Respectfully submitted,

Date: April 12 2005

Mara E. Liepa
Reg. No. 40,066

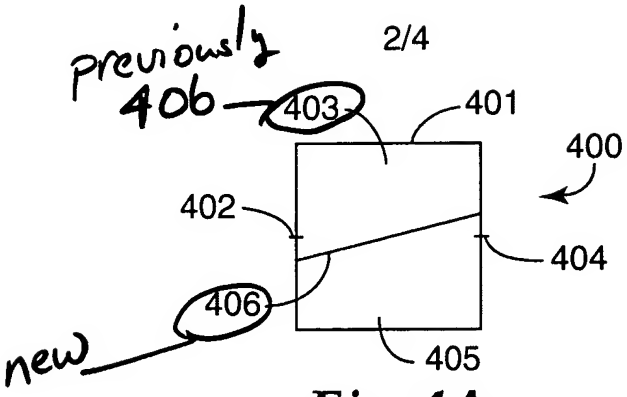


Fig. 4A

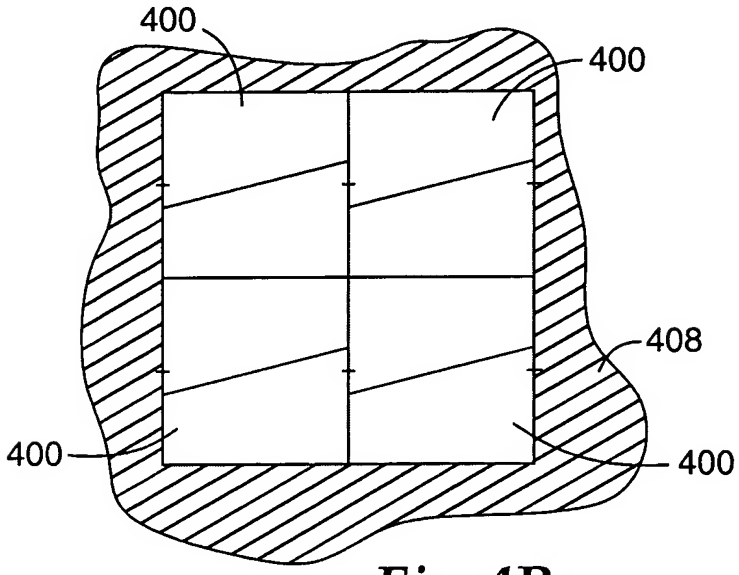


Fig. 4B

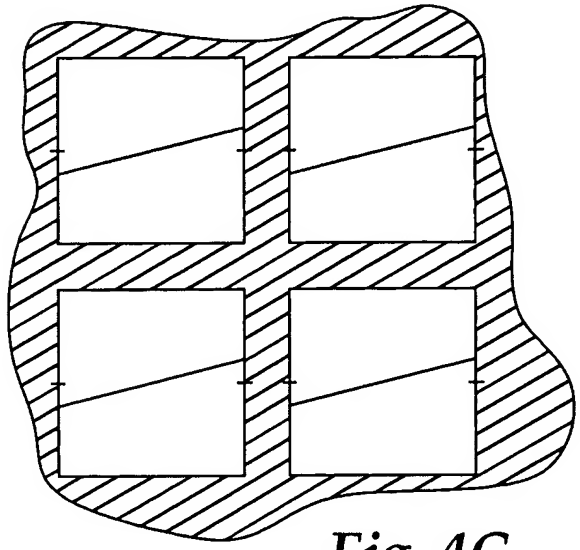


Fig. 4C

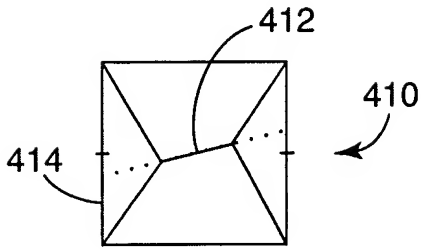


Fig. 4D

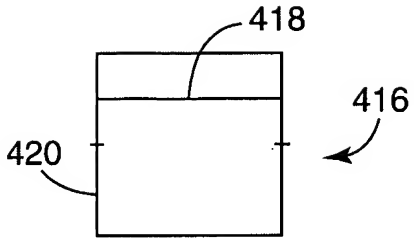


Fig. 4E

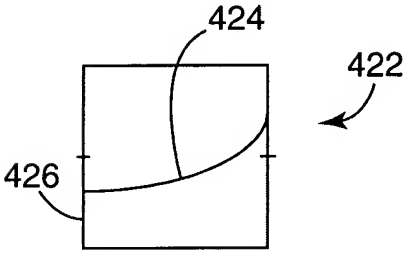


Fig. 4F

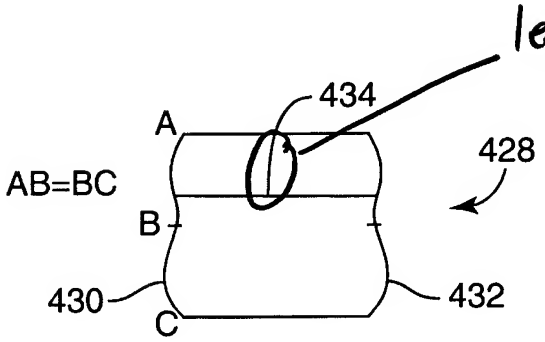


Fig. 4G

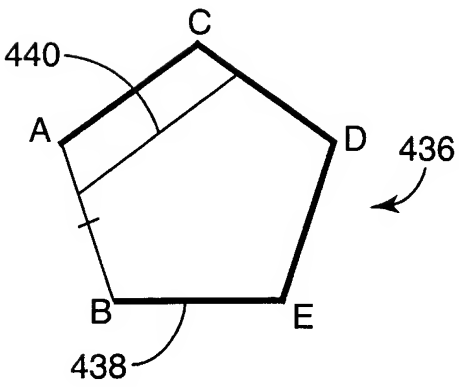


Fig. 4H

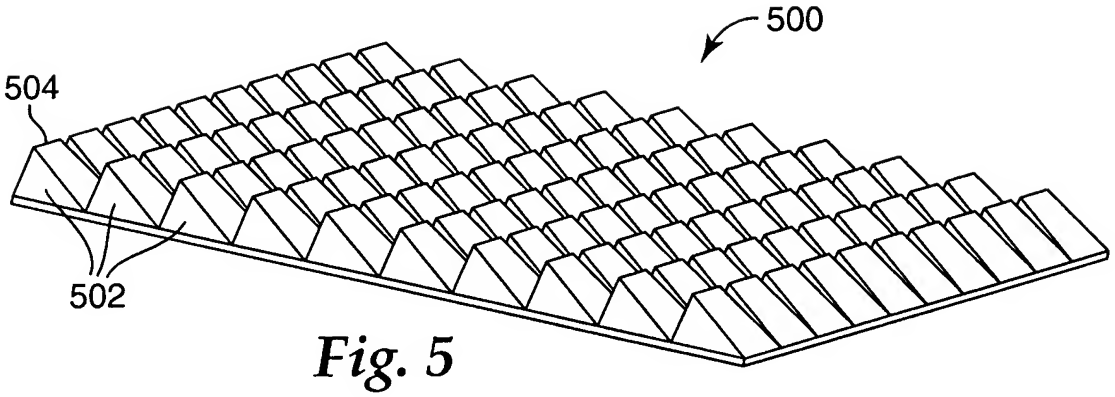


Fig. 5

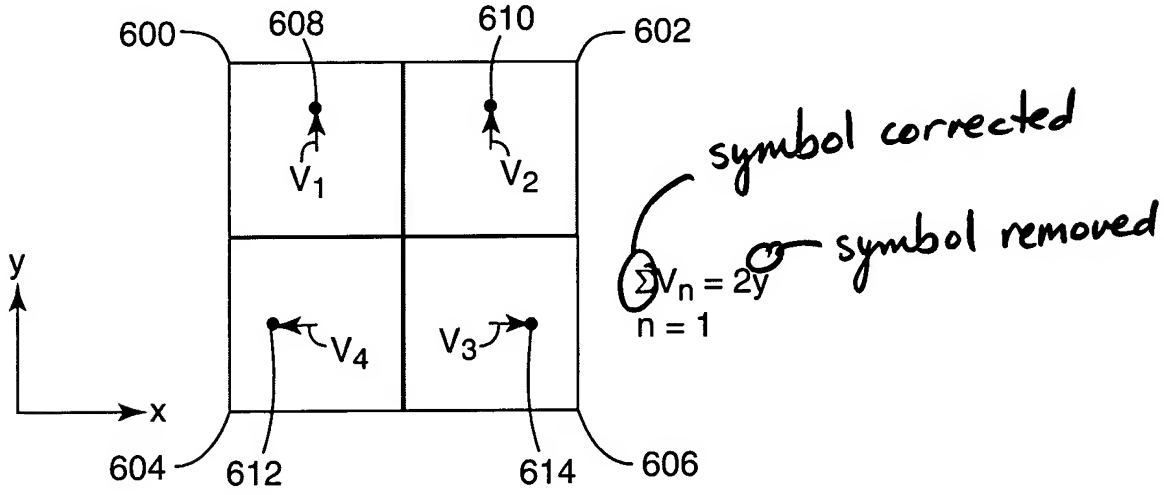


Fig. 6A

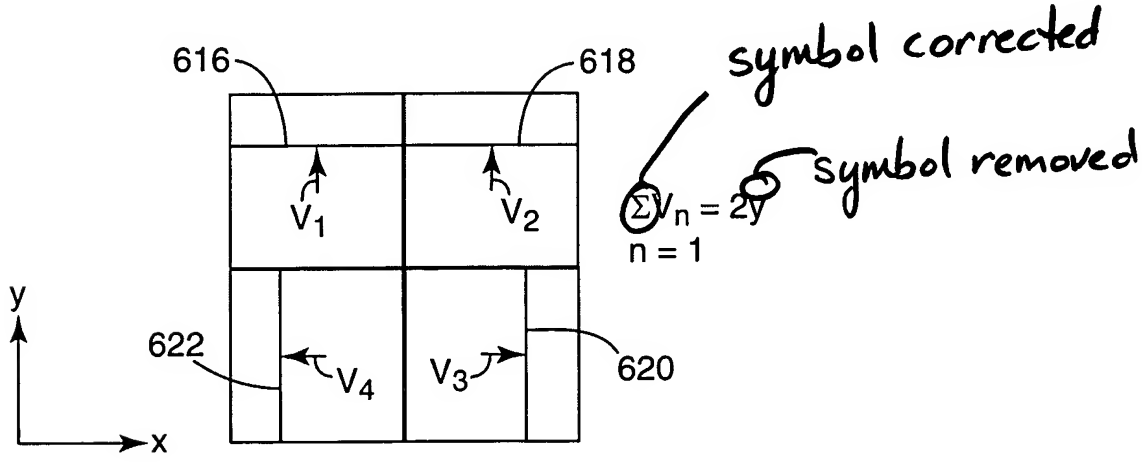


Fig. 6B